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DRY-SEASON IRRIGATION FARMING AT THE WESTERN FOOT OF THE NORTH PARE MOUNTAINS, TANZANIA

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ABSTRACT A small-scale irrigation farming activity had been performed at the foot of one mountain in northeastern Tanzania during the dry season from the early 1990s. Although currently inoperative, this activity represented one example of local initiative in response to wider politico-socio-economic changes after the era of structural adjustment. When the individuals at my research site encounter economic hardship, they use their traditional adaptability to develop this approach to survival. The first aim of this article is to describe the details of these activities because no official and/or private written records of this activity exist. The second aim is to provide evidence of the norms underpinning the organizational efforts that reached beyond the level of individual households in Tanzania and were initiated in the context of limited resources such as water.

Key Words: Food security; Livelihood; Irrigation; Coping strategy; Tanzania.

INTRODUCTION

At the western foot of the North Pare Mountains in Mwanga District, Tanzania, irrigation farming activities during the dry season (July to October) were observed since the early 1990s. This dry-season irrigation farming is a 'modern' activity with a 'traditional' irrigation facilities. The Pare people living in the North Pare Mountains were engaged in irrigation farming with "*ndiva*"s (*ndiva* is a small reservoir in the Pare language) and furrows on the mountain slopes since even before the colonial era started in the 1880s (Kimambo, 1991; Yoshida, 1985). During the 1930s to 1950s, new furrows from *ndiva*s seems to reach to my research site at the western foot of the North Pare Mountains for irrigating the cotton fields. Then, keeping pace with the decline of cotton production, these indigenous irrigation facilities were gradually abandoned.

These facilities were reused since the early 1990s when dry-season irrigation farming activities were started. The cost-sharing policies on education and health sectors under the Structural Adjustment Program (SAPs) since 1986 in Tanzania brought economic hardships to individual households, especially in rural areas. This negative impact of SAPs triggered the dry-season irrigation farming in my research site as one of the coping strategies. However, this agricultural activity declined drastically in the late 2000s. During the recent four years since 2007 to 2010, nobody tried dry-season irrigation farming. As a result, the furrows covered with soil and grasses look like just small paths. The most possible reason of poor performance was the emergence of more profitable alternative for livelihood strategies, such as the manufacture and sale of burnt bricks and gravel as building materials under a construction boom at the adjacent local town, Mwanga Town

led by the new national development policy introduced in 2000; the Poverty Reduction Strategy.

This irrigation activity practiced in small scale is not so meaningful from the perspective of the agricultural development, but it is significant from the viewpoint of an expression of the local initiatives to cope with the changing socio-economic conditions brought by the new national development policies. Unfortunately, there are no documentation on this activities. Neither the participants of this activities kept any written records, nor the Department of Agriculture and Livestock Development (DALDO Office) in Mwanga District had any official reports mentioning to this activities. Therefore, the first aim of this article is to record the detail of this irrigation farming observed in the 1990s to the early 2000s.

Then, the second aim is to show an example of the norm underpinning the collective agricultural activity beyond the level of individual household. In the rain-fed farming area in Tanzania such as my research site, the normal agricultural activities are performed by each household composed with rather small number of members. They do not need any collective actions beyond household level at least as for agricultural activity. On the contrary, the irrigation farming with the limited water supply requires some arrangements on water use. In my research site, the arrangement on land use, i.e. the rental practice of irrigation plots is also common. I would like to show how they organize and negotiate to enable dry-season irrigation farming as the collective action beyond the level of relatively independent rural households.

OVERVIEW OF RESEARCH SITE

Mwanga District is one of seven districts of Kilimanjaro Region in northeastern Tanzania. The North Pare Mountains, which run from north to south, divide this district into two agro-ecological zones: the mountains (808 km^2, *Milimani* in Kiswahili and *Vuasu* in the Pare language) and the plains (1,833 km^2, *Tambarare* in Kiswahili and *Nyika* in the Pare language) (see Fig. 1). Many rural households in the mountains cultivate Arabica coffee and cardamom as cash crops and bananas as a staple crop. Additionally, they often plant maize and other food crops on their fields in the plains. On the other hand, most rural households on the plains have neither fields in the mountains nor profitable cash crops on the plains and primarily cultivate food crops such as maize and pulses for self-consumption.

The rainfall patterns of both agro-ecological zones in this district are bimodal which include the long rains (*Masika* in Kiswahili) from March to June and the short rains (*Vuli*) from October to January. The period of the long rains serves as the main farming period in the plains, whereas the period of the short rains is more important in the mountains. The long dry season (*Kiangazi* or *Kipupwe*) from July to October is normally the agricultural off-season on the plains, but some individuals living near Kirisi hamlet at the western foot of the North Pare Mountains started to practice irrigation farming during the dry season in the early 1990s (see Fig. 1).

Kirisi hamlet is administratively within Vudoi Sub-village (*Kitongoji*), which is

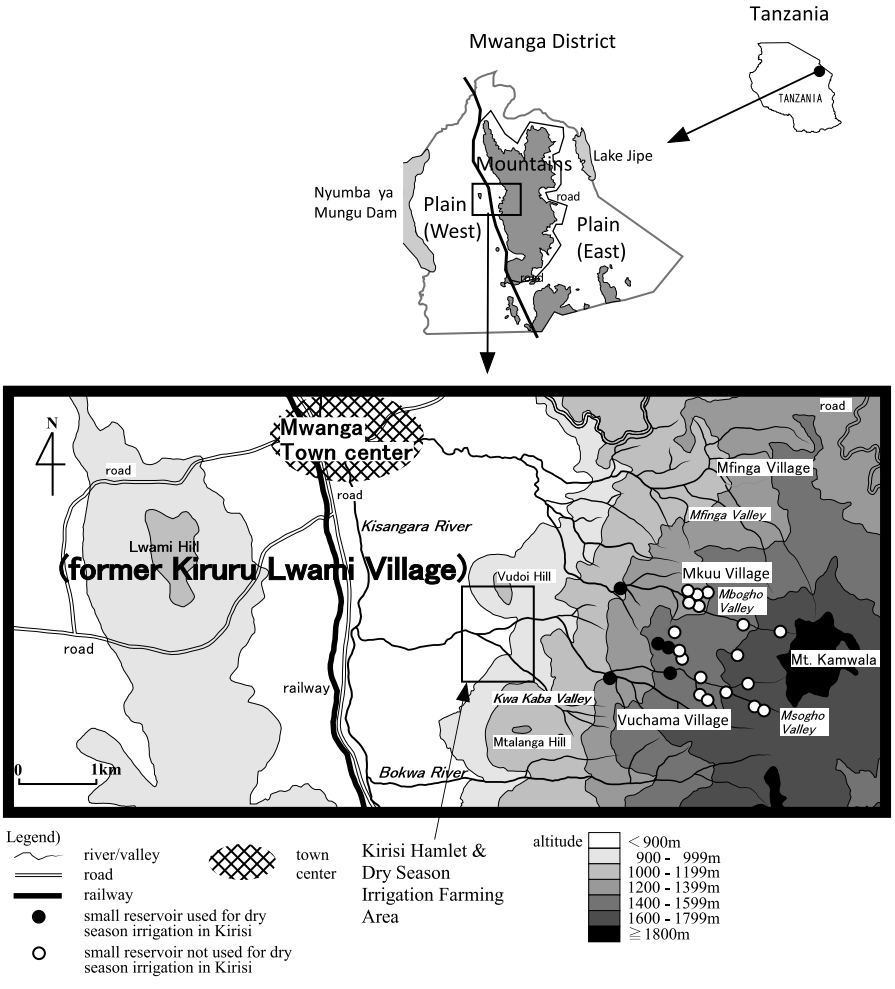


Fig. 1. Area around Kirisi Hamlet and Dry-Season Irrigation Farming.
Source: Original Map: TMAP73/1.
Small Reservoirs: Survey by IKENO with GPS (1998, 2000, 2001, 2003, 2004, 2005 & 2006).

one of four sub-villages in what had been the village of Kiruru Lwami before becoming one of 12 sub-villages of the Small Township of Mwanga (*Mamraka ya Mji Mdogo*) when the former village of Kiruru Lwami was incorporated into the administrative area of the present Mwanga Town during the early 1990s[(1)]. Kirisi hamlet is about a 40-minute walk from the center of Mwanga Town.

The smallest official administrative unit is the sub-village; however, residents subdivide Vudoi Sub-village into Kirisi and Mramba hamlets (*mtaa*, pl. *mitaa*) because residents of the two hamlets originated from different mountain villages during the early 1970s under the Ujamaa Village Policy which was the main component of policies promoting African socialism in Tanzania. Fig. 1 shows that the areas above the contour line of 1,100–1,200 m belong to other villages in the mountains; moving from north to south, one can observe Mfinga, Mkuu, and

Vuchama villages. Most residents of Kirisi hamlet migrated from the general direction of Mkuu and Vuchama villages, whereas residents of Mramba hamlet migrated from the general direction of Mfinga village.

Kirisi hamlet contained 45 households with 282 residents in August 1997, 55 households with 323 residents in August 2006 and 58 households in August 2008. Most household heads are members of the Fangavo or Finanga clans of Pare's patrilineal system of descent. Additionally, six couples in which both husbands and wives are Kirisi in origin are residents of this hamlet. Therefore, households in Kirisi are close in terms of kinship, affine relations and place of residence. Despite these tight social relationships, my observations since 1995 indicate that each household seems to constitute an independent entity in terms of daily economic activities. For instance, from the early 1999 to the middle of 2000, when many Kirisi households were suffering from continuous poor harvests due to rainfall shortages, each household devised its own measures cope with the food shortages resulting from this serious common hardship.

Nearly half of the households in Kirisi practice more than one income-generating activity even during normal years, and agriculture is clearly the most important activity practiced by the residents of this hamlet. Kirisi inhabitants use their upland fields for farming during the long rains, the main farming season, whereas half of the households can also use fertile fields on the banks of the Kisangara River (*kitivo* in the Pare language), and some can use fields in the mountains. The irrigation farming practiced during the dry seasons (from July to October) constitutes additional farming activity, which I will discuss below.

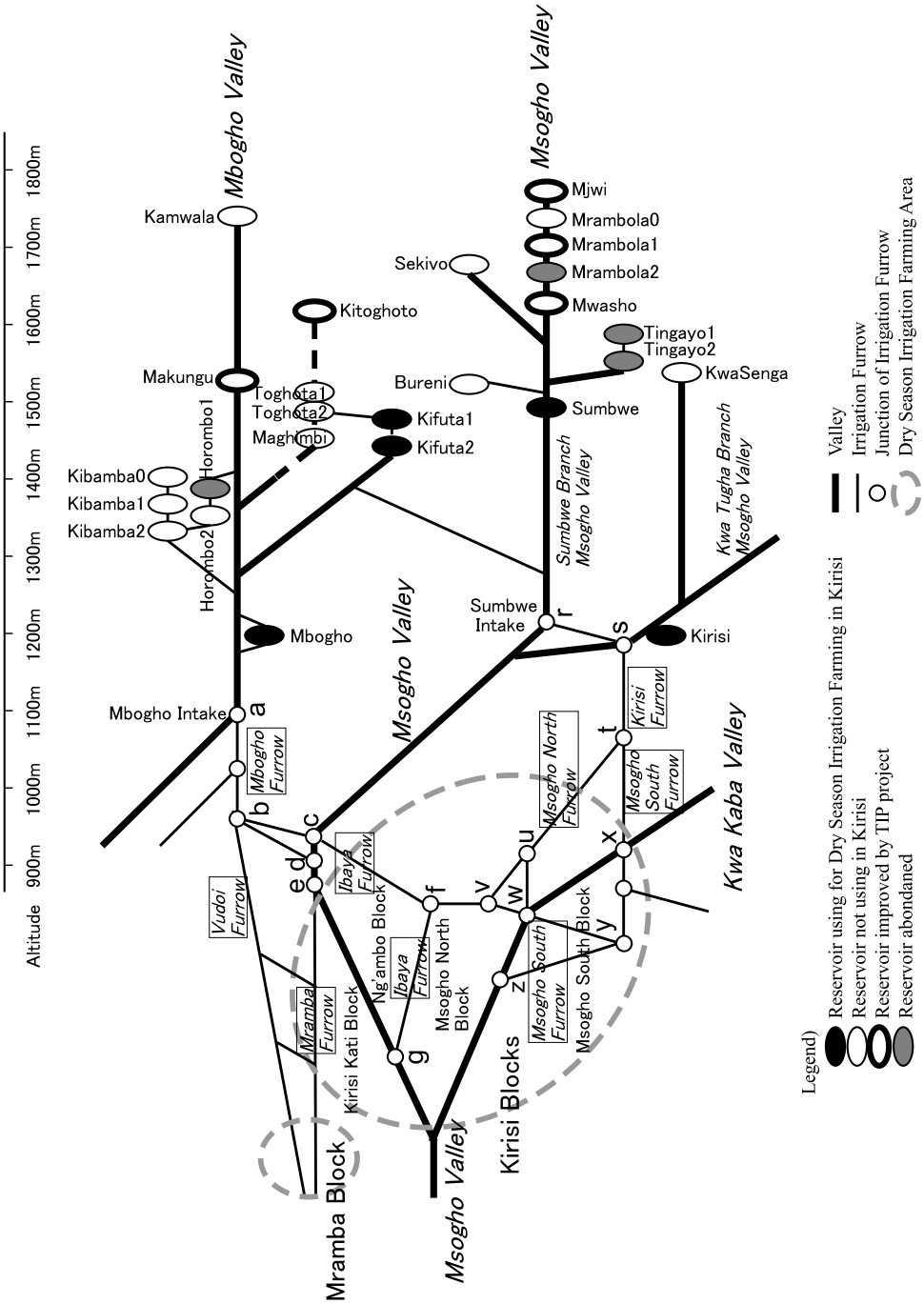
Of the land used for cultivation in the former village of Kiruru Lwami, only the fields adjacent to Kirisi (and some of the fields in Mramba) are suitable for irrigation farming during the dry season due to their proximity to the North Pare Mountains. As shown in Fig. 1, plots used for dry-season irrigation farming are located in the area around the junction of the Msogho and Kwa Kaba valleys, which is less than 900 m above sea level. During the dry season, no water exists in either valley near Kirisi hamlet.

RESOURCES ENABLING DRY-SEASON IRRIGATION FARMING NEAR KIRISI

I. Small Reservoir (*ndiva*)

The water supply for dry-season irrigation farming near Kirisi hamlet originates from *ndiva*s. Many *ndiva*s have been built along the Mbogho and Msogho valleys on the western slope of Mount Kamwala (see Fig. 1), one of the peaks of the North Pare Mountains. Even in the upper streams of both valleys, running water does not exist during the dry season. Therefore, the main sources of water for the *ndiva*s are tiny springs that spew water retained during previous long rains. Because dry-season irrigation farming relies on rainfall during the long rains, this farming activity is unable to compensate for the poor harvests during the long rains due to the shortage of rain.

In the case of dry-season irrigation farming near Kirisi hamlet, water is usually



Source) Survey by IKENO (1998, 2000, 2003, 2005 & 2006)

Fig. 2. *Ndivas*, Furrows and Field Blocks for Dry Season Irrigation Farming.

reserved in a *ndiva* for half a day. Members of a group allowed to use the water in a *ndiva* close a small hole on the bottom of its front wall, which acts as a water gate, with small wooden boards and soil during the afternoon of the day before water use. Early the next morning, member(s) of that group visit the *ndiva* to open the water gate and then open or close various junctions of furrows with stones and soils to direct the water to their irrigation plots.

The locations and connections of all *ndiva*s, furrows and irrigation plots are shown schematically in Fig. 2. Fourteen *ndiva*s are located on or along Mbogho Valley in Mkuu Village. On the other hand, Twelve *ndiva*s are located on and along Msogho Valley in Vuchama Village.

Of the 26 total *ndiva*s, only five that were constructed downstream have been used for dry season irrigation farming near Kirisi hamlet: *Ndiva ya Mbogho*, *Ndiva ya Kifuta 1*, and *Ndiva ya Kifuta 2* on or along Mbogho Valley and *Ndiva ya Sumbwe* and *Ndiva ya Kirisi* on or along Msogho Valley. *Ndiva ya Sumbwe*, *Ndiva ya Kifuta 1* and *Kifuta 2* are nearly 1,500 m above sea level, almost 600 m higher than the irrigation plots near Kirisi hamlet. As these five *ndiva*s are located outside of Kirisi hamlet, those who use water for dry-season irrigation farming near Kirisi need to negotiate with people who use water in the mountains, which I will discuss later.

II. Furrow

Two furrow networks existed at the time of this study: the Mbogho furrow system and the Msogho furrow system.

1. The Mbogho furrow system

The Mbogho furrow system had only one *ndiva*, *Ndiva ya Mbogho*. *Ndiva ya Mbogho* was built on the side of the Mbogho Valley. Water led by a furrow from a small intake opening at the Mbogho Valley was kept in a reservoir, *Ndiva ya Mbogho*. Water from *Ndiva ya Mbogho* was immediately returned to the Mbogho Valley, and the Mbogho Valley itself was then used as a furrow to guide water to intake point “a” in Fig. 2, where water was led to the Mbogho furrow. At point “b”, water flowed into one of three furrows.

The first was the Vudoi furrow, which was located on the slope of Vudoi hill and which distributed water to irrigation plots in the Kirisi Kati and Mramba blocks[(2)]. The second was the Mramba furrow. Water from point “b” flowed into the Msogho Valley at point “d” and then flowed within the Msogho Valley to point “e”. Starting at point “e”, the Mramba furrow distributed water to the lower part of the irrigation plots in the Kirisi Kati and Mramba blocks. The third furrow was the Ibaya furrow. Water from point “b” crossed the Msogho Valley at point “c”, then turned at point “f”, ran to point “g”, and flowed into the Msogho Valley again. This furrow distributed water to irrigation plots in the Ng’ambo block.

2. The Msogho furrow system

The Msogho furrow system included four *nvidas*. The main *ndiva* was *Ndiva ya Sumbwe*, which was located on the Sumbwe branch of the Msogho Valley.

Water from *Ndiva ya Sumbwe* ran in the Sumbwe branch to the intake at point "r". Water from *Ndiva ya Kifuta 1* and *Kifuta 2* merged into this stream of water on the way to "r". Despite their locations in the Mbogho Valley, water from *Ndiva ya Kifuta 1* and *Kifuta 2* was used for the Msogho furrow system. Water was again added at point "s", this time from *Ndiva ya Kirisi*, which was located in another branch of the Msogho Valley. At point "t", water from the the Kirisi furrow flowed into one of two furrows.

One possible destination was the Msogho north furrow. Water finally flowed into the Kwa Kaba Valley after being distributed to irrigation plots in the Msogho north block through route u - v - w, or into the lower part of the irrigation plots in the Msogho south block through route u - w - y - z. Another destination was the Msogho south furrow. Water from "t" crossed the Kwa Kaba Valley at point "x" and ran through "y", it then flowed into the Kwa Kaba Valley at point "z". This furrow distributed water to irrigation plots in the Msogho south block.

Water from five *ndiva*s reached irrigation plots in the Kirisi blocks (Kirisi Kati, Ng'ambo, Msogho north and Msogho south) and in the Mramba block. These furrow networks were rather complex. As already mentioned, several furrows crossed the adjacent valley. Moreover, the Mbogho and Msogho furrow systems were connected at points "f" and "v". Because the altitudes at "f" and "v" did not differ from each other, water coming from "f" could go to "w" through "v", and water coming from "v" could travel to "g" through "f", enabling additional flexibility even beyond that afforded by the design of the furrow system itself.

III. Irrigation Plot

Dry-season irrigation farming activities used fields adjacent to Kirisi hamlet (and to Mramba hamlet in 1998 and 1999). However, the irrigation plots were not permanent and changed from year to year. An "irrigation plot" usually occupied only a small part of a "field", which was a patch of land typically possessed by one "field holder", who was approved according to Pare's land-transaction rule. Field holders are typically sons who are gifted and/or inherit a patch of land from their fathers, although several exceptions to this general rule exist. The area near Kirisi hamlet had been recognized as belonging to the Fangavo clan because members of this clan were the first residents of this area. Fangavo elders only one generation removed from the current cohort had allocated a patch of land to members of other clans as well as to those in their own clan. Therefore, the present field holders near Kirisi hamlet are the persons designated as recipients by Fangavo elders or their close descendants. It is noteworthy that the holders of fields near Kirisi hamlet do not necessarily live in Kirisi; some live in other subvillages of the former Kiruru Lwami Village, whereas others live in other villages in the mountains. Also of note is that the Fangavo clan as a whole is not currently the dominant field holder near Kirisi in terms of numbers of fields held and total acreage. The elders of the Fangavo clan were kind enough to allocate patches of land to other clans.

An irrigation plot is a patch of land used for irrigation farming by a "plot user

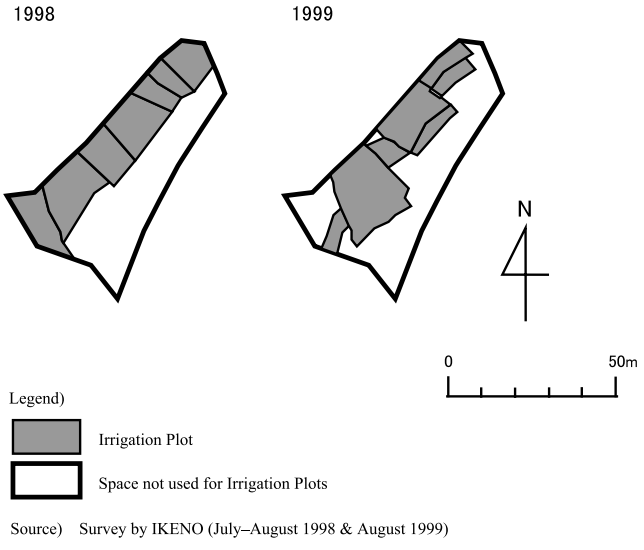


Fig. 3. Multiple Irrigation Plots within One field.

or plot users" during one dry season. It is common to demarcate more than one "irrigation plot" within a single field. Moreover, the user of one irrigation plot is not necessarily the same person as the "holder" of the "field" in which the "plot" is located. Fig. 3 presents a typical example of several irrigation plots existing within one field during 1998 and 1999. This one field contained seven irrigation plots during both years, although the shapes of the plots varied. The field holder used one of seven irrigation plots in both years, but rented the remaining six plots to his relatives, neighbors, and friends.

THE SCALE OF DRY-SEASON IRRIGATION FARMING NEAR KIRISI

I. Calculation of the Relevant Statistics for Dry-season Irrigation Farming

Fig. 4 presents a schematic representation of the observed relationships between fields and irrigation plots. Four fields, held by X, Y, and Z (all are males) are depicted. X possessed two fields. His first field contained three irrigation plots, one of which was used by X himself, another of which was used by Y, and the third of which was used by both X and A. As a plot user, A constructed an irrigation plot connecting parts of Y's and Z's fields. Therefore, one plot user (A) used the fields of two holders (Y and Z) for irrigation farming. Y also used an irrigation plot with B in Z's field. X's wife used an irrigation plot in X's second field.

The model described above involved three actual field holders (X, Y, and Z), four fields (two for X and one each for Y and Z), six irrigation plots (for X, Y, X and A jointly, A, Y and B jointly, and X's wife), five actual plot users (X, Y, A, B, and X's wife), and eight plot-using roles (X, Y, and A for two plots each and B and X's wife for one plot each). The number of roles for plot users matched

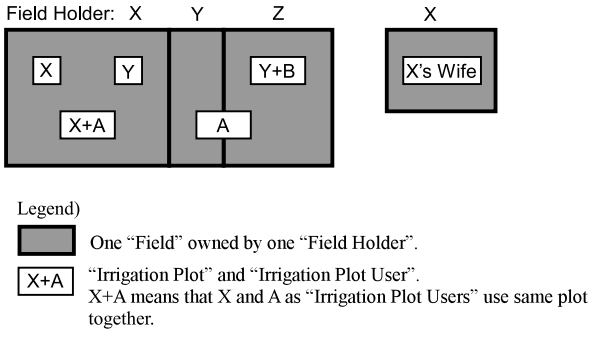


Fig. 4. Model of Irrigation Plot.

the number of the plot rentals between field holders and plot users, including cases in which the field holder used a part of his/her own field for irrigation plots.

For example, Y was a field holder who did not use his own field, but used a part of other field holder's fields as his irrigation plots. Therefore, he was regarded as a plot user who performed irrigation farming on a rented plot. X's wife also used the plot "rented" from her husband, but she was regarded as using her own (household's) plot because it was owned by a member of her household (her husband).

If only X attempted to practice irrigation farming within one of his fields during the next year, the figures involved would change as follows; one field holder (X), one field (X's), one irrigation plot (X's), and one plot user (X) in terms of both numbers of people and numbers of roles. When the total number of irrigation farms during the subsequent 2 years is considered, the numbers would change as follows: three actual field holders (X, Y, and Z) and four actual fields (two for X and one each for Y and Z). These figures are unchanged because neither a new field holder nor a new field was designated during the second year. The five actual plot users (X, Y, A, B, and X's wife) would also remain unchanged, but the number of roles would increase to nine from eight because one would be added (X during the second year).

II. Trends in Dry-season Irrigation Farming near Kirisi

Table 1 shows the scale of dry-season irrigation farming near Kirisi hamlet at the western foot of the North Pare Mountains according to the method of calculation discussed above. Irrigation farming was practiced during nine of the 16 years from 1995 to 2010: 1995, 1996, 1998, 1999, 2000, 2001, 2003, 2004 and 2006. Unfortunately, because I could not conduct a research in 2001, data on dry-season irrigation farming are presented for only 8 of those 9 years.

A total of 247 irrigation plots within 42 fields were demarcated during these 8 years; these were owned by 39 actual field holders. The fields in the Mramba block near Mramba hamlet were used only in 1998 and 1999, 14 irrigation plots were used in 1998, and two were used in 1999. During these 8 years, a total of 290 roles (128 filled by males and 162 filled by females) and 134 actual individuals (59 males and 75 females) were involved in these farming endeavors.

Fig. 5 shows the distribution of irrigation plots in the Kirisi and Mramba blocks

Table 1. Trend of Dry Season Irrigation Farming (1995–2010)

		Field Holder	Field	Irri. Plot	Irrigation Plot User (person)					
					number of role			actual		
					male	female	total	male	female	total
1995	Kirisi	12	12	34	18	17	35	16	17	33
1996	Kirisi	11	12	28	14	18	32	11	16	27
1997	Kirisi	0	0	0	0	0	0	0	0	0
1998	Total	37	39	65	40	42	82	33	34	67
	Kirisi	23	25	51	30	38	68	23	30	53
	Mramba	14	14	14	10	4	14	10	4	14
1999	Total	13	13	35	22	17	39	19	17	36
	Kirisi	11	11	33	20	17	37	17	17	34
	Mramba	2	2	2	2	0	2	2	0	2
2000	Kirisi	11	11	46	19	34	53	13	27	40
2001	Kirisi	?	?	?	?	?	?	?	?	?
2002	Kirisi	0	0	0	0	0	0	0	0	0
2003	Kirisi	5	5	13	3	12	15	2	11	13
2004	Kirisi	5	5	15	6	12	18	5	11	16
2005	Kirisi	0	0	0	0	0	0	0	0	0
2006	Kirisi	6	6	11	6	10	16	3	10	13
2007	Kirisi	0	0	0	0	0	0	0	0	0
2008	Kirisi	0	0	0	0	0	0	0	0	0
2009	Kirisi	0	0	0	0	0	0	0	0	0
2010	Kirisi	0	0	0	0	0	0	0	0	0
Total		actual	actual	multi.	number of role			actual		
	Total	39	42	247	128	162	290	59	75	134
	Kirisi	25	28	231	116	158	274	49	71	120
	Mramba	14	14	16	12	4	16	10	4	14

Source: Survey by IKENO (1995–2010).

Note: 1) Kirisi=irrigation plots within fields of Kirisi Blocks (KIrisi Kati, KIrisi Ng'ambo, Msogho North or Msogho South Block), Mramba=irrigation plot within field of Mramba Block.

2) In 1998 and 1999, irrigation farming were performed even on the fields of Mramba Field Block. 14 out of 65 irrigation plots in 1998 and 2 out of 35 plots in 1999 were in Mramba Block.

in 1998, when dry-season irrigation farming was practiced most prevalently. The upper side shows the irrigation plots in the Mramba block. The size of the irrigation plots is tiny, the average size of 61 of the 65 plots in 1998 was 0.08 ha, and the largest plot was 0.27 ha.

As shown in Table 1, dry-season irrigation farming near Kirisi was more active in the late 1990s than in the 2000s. To explain this trend, the residents of Kirisi hamlet referred to the shortage of water due to the low levels of water produced by the long rains, which served as the main source for the springs of the upper stream feeding the *ndiva*s. However, these conclusions were not validated by the annual rainfall data compiled by the Department of Agriculture and Livestock Development of the Mwanga District. A more reasonable cause of the water shortage was the increased use of water in the mountains. Beginning in the late 1990s, when the producer's price of coffee decreased and became unstable, farmers

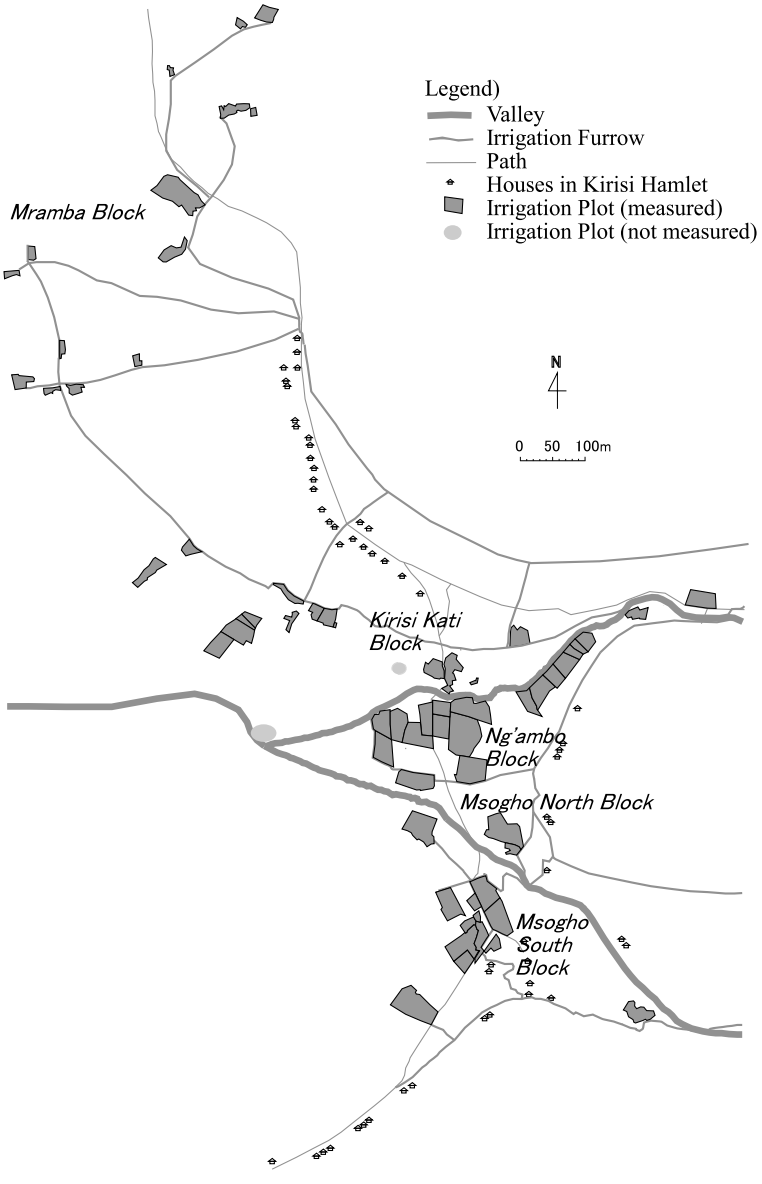


Fig. 5. Distribution of Irrigation Plots in 1998.
Source: Survey by IKENO (1998).

in the mountains increased the practice of producing vegetables for sale. Although the scale of vegetable produce remains unknown, this practice clearly required more year-round water than did coffee. In addition to the water used for agricultural activity, the increased number of secondary schools established during the 2000s under the Poverty Reduction Strategy increased water consumption for domestic use at school dormitories and other facilities in the mountains. More frequent use of *ndiva*s in the upper streams and newly built intake facilities for piped water

reduced the water inflow to the downstream *ndiva*s, and hence the water that was available for irrigation farming in Kirisi. Moreover, residents of Kirisi hamlet seem to have lost their enthusiasm for irrigation farming because of the emergence of profitable non-farm activities during the construction boom in Mwanga Town. The manufacture and sale of burnt bricks and gravel has become common in Kirisi since the middle of the 2000s, and plot users from outside could not continue dry-season irrigation farming when the residents of Kirisi, the core members of this agricultural activity, withdrew.

ACTORS AND NEGOTIATIONS INVOLVED IN DRY-SEASON IRRIGATION FARMING

I already mentioned field holders and plot users, but other individuals and groups were also involved in dry-season irrigation farming; these included the water distributor (*Mgawanya Maji*), water-rotation groups (*Kikundi*, pl. *Vikundi*), and water-users groups. Plot users, as the direct practitioners of dry-season irrigation farming, could meet their goals through maintaining social relationships and negotiating with these other actors.

I. Who were the Field Holders and Plot Users?

As shown in Table 1, the 42 fields that were used, at least in part, for irrigation farming from 1995 to 2010 were owned by 39 field holders. Of these 42 fields, 14 in the Mramba block were owned by 14 field holders living in Mramba hamlet. The other 28 fields in the Kirisi blocks were owned by 25 field holders. Unlike the field holders in the Mramba block, the field holders in the Kirisi blocks were not necessarily residents of Kirisi hamlet. Indeed, 17 residents of Kirisi hamlet owned 20 fields, four residents of other sub-village of the former Kiruru Lwami

Table 2. Relation between Fileld Holder and Irrigation Plot User (1995–2010)

Total person (female)

Residence / Kinship	same Households	same Hamlet	same Sub-village	same Village	other Village	Total
Self	64 (18)	0 (0)	0 (0)	0 (0)	0 (0)	64 (18)
Wife(Spouse)	19 (19)	1 (1)	0 (0)	0 (0)	0 (0)	20 (20)
Child/Parent	19 (15)	14 (1)	0 (0)	2 (2)	7 (6)	42 (24)
Near Kin	2 (2)	29 (16)	5 (4)	8 (3)	10 (4)	54 (29)
Distant Kin	0 (0)	29 (17)	0 (0)	7 (5)	15 (14)	51 (36)
No Kinship	0 (0)	8 (6)	9 (8)	12 (5)	30 (16)	59 (35)
Total	104 (54)	81 (41)	14 (12)	29 (15)	62 (40)	290 (162)

Source: Survey by IKENO (1995, 1996, 1998, 1999, 2000, 2003, 2004, 2005 & 2006).
Note: 1) In the case which a wife of the field holder is the irrigation plot user, one is counted in the column of "Wife(Spouse)".
2) 16 irrigation plots on Mramba Field Block using in 1998 & 1999 are included. 15 out of 16 were used by field holders themselves, and one was used by the wife of the field holder.

Village owned four fields, and four residents of other villages in the mountains owned four fields. About one-third of the fields near Kirisi were owned by outsiders, and only 17 residents (heads of household) of approximately 50 households in Kirisi had fields that were suitable for dry-season irrigation farming. This evidence on land tenure underscores the complexity of land ownership in rural Tanzania.

Dry-season irrigation farming near Kirisi hamlet became more complicated because the field holders or their household members were not necessarily the plot users. As illustrated in Fig. 4, the number of land transactions (including those involving use by the holder himself/herself) was same as the number of roles filled by plot users (i.e., the same individual holding multiple roles), 290, as shown in Table 1. These 290 land transactions between field holders and plot users for dry-season irrigation farming during 1995 to 2010 (with data collected for only 8 years) are redistributed in Table 2 according to kinship/affine relationships and distances among residences. For instance, "wife (spouse)" in Table 2 indicated that the plot user was a wife of the field holder, whereas "other village" indicates that the plot user lived in a different village from that of the field holder.

Although the field holders themselves and their household members (wives and children/parents) were dominant plot users, it was surprising to find 59 cases in which the plot users did not have kinship/affine relationship with the field holders and 62 cases in which the plot users and the field holders lived in different villages. Several field holders whom I interviewed did not know the plot users personally. These field holders were asked by their relatives and/or neighbors to rent parts of their fields to the plot users, reflecting that the norm for participation in dry-season irrigation farming near Kirisi hamlet was rather loose and allowed for open access. Even a resident of the mountains without any kinship/affine relationship with residents of Kirisi hamlet was able to ask to farm an irrigation plot.

The actual numbers of plot users from 1995 to 2010 was 134. Table 3 shows the distribution of these 134 plot users by place of residence and number of years performing irrigation farming. It is surprising that the residents of Kirisi were fewer than half (60 of 134) of all plot users and that most plot users performed irrigation farming in only one year (92 out of 134). The relationships between field holders and plot users were neither consistent nor determined by any stratified

Table 3. Distribution of Irrigation Plot Users by Years of Farming Activity and Residence (1995–2010)

Total person (female)

Year	1 year	2 years	3 years	4 years	5 years	6 years	7 years	8 years	TOTAL
Residence									
Kirisi Hamlet	33 (15)	8 (7)	4 (2)	4 (2)	3 (1)	1 (0)	2 (1)	5 (4)	60 (32)
Mramba Hamlet	17 (7)	3 (1)							20 (8)
Within Village	19 (11)	3 (3)							22 (14)
Other Village	23 (15)	6 (4)	2 (1)	1 (1)					32 (21)
Total	92 (48)	20 (15)	6 (3)	5 (3)	3 (1)	1 (0)	2 (1)	5 (4)	134 (75)

Source: Survey by IKENO (1995–2010).
Note: Dry-season irrigation farming was observed only in 8 years; 1995, 1996, 1998, 1999, 2000, 2003, 2004 & 2006.

Table 4. Distribution of Irrigation Plot Users by Years of Farming Activity and Type of Plot (1995–2010)

Total person (female)

Year	1 year	2 years	3 years	4 years	5 years	6 years	7 years	8 years	TOTAL
Type of Plot									
Self only	26 (10)	6 (2)	1 (0)	2 (1)	0 (0)	0 (0)	0 (0)	2 (2)	37 (15)
Self+Rent	2 (1)	2 (2)	3 (2)	1 (0)	2 (1)	0 (0)	2 (1)	2 (1)	14 (8)
Rent only	64 (37)	12 (11)	2 (1)	2 (2)	1 (0)	1 (0)	0 (0)	1 (1)	83 (52)
Total	92 (48)	20 (15)	6 (3)	5 (3)	3 (1)	1 (0)	2 (1)	5 (4)	134 (75)

Source: Survey by IKENO (1995–2010).

Note: 1) Dry-season irrigation farming was observed only in 8 years; 1995, 1996, 1998, 1999, 2000, 2003, 2004 & 2006.

2) Self=The plot users who used the irrigation plot within the fields owned by the plot users themselves or by the household members staying together. For instance, when one woman used part of her husband's field, her plot was a "self" plot.
Rent=The plot users who used the irrigation plots other than "self" plots.
Self+Rent=The plot users who used the plots of both categories.

social structure, but rather temporary or seasonal. These data also validate that the norm for participation in dry-season irrigation farming near Kirisi hamlet was rather loose and open. We can also observe that about 10 enthusiastic plot users who were Kirisi residents practiced this type of farming for more than 4 years. Table 4 shows that only 37 of 134 plot users cultivated their own plots. Thus, even several of the enthusiastic plot users depended on rented plots.

According to the data shown in Tables 3 and 4, it is clear that different plot users entered this farming activity for the first time each year and that land rental arrangements were temporary. Irrespective of the type of relationship between field holders and plot users, with only one exception, no rent was charged for the use of the irrigation plots. The plot users did not even offer field holders any kinds of gifts (e.g., a pot of local beer, *Mbuta*), which differs from land rental arrangements in the mountains, where the land users had to pay rental charges and/or provide gifts to land owners (Yoshida, 1995; Maghimbi, 1992).

The rental arrangements for dry-season irrigation farming seemed akin to a kind of mutual help system between field holders and plot users despite the fact that the two groups did not know each other personally. It is noteworthy that this mutual help arrangement functioned among residents of different villages and among non-relatives. These observations serve as additional evidence that dry-season irrigation farming was practiced with openness and flexibility that extended participation beyond a small local community.

II. Water Distributors (*Mgawanya Maji*, pl. *Wagawanya Maji*) and Their Role

Those who used plots for dry-season irrigation were regarded as a water-users group. Two water-users groups operated during dry-season farming near Kirisi hamlet. One was composed of those who used plots located on the fields of the Kirisi Kati, Kirisi Ng'ambo, and Mramba blocks, who depended on the Mbogho furrow system for their water supply. The second water users group was composed

of those who used plots in the fields of the Msogho north and Msogho south blocks and depended mainly on the water supply from the Msogho furrow system. As the plot users changed over the course of the years, the composition of such water-users group changed accordingly.

Although the water supplies provided by both furrow systems were not abundant, water was available for 5–8 hours per day. Therefore, the plot users needed to establish an arrangement for water use and choose a water distributor (*Mgawanya Maji* or *Kiongozi wa Maji*) for each furrow system as the supervisor of dry-season irrigation farming for each year. Two water distributors were selected for the dry-season irrigation system: one for the Mbogho furrow system and another for the Msogho furrow system. It is claimed that plot users selected qualified persons to serve as their water distributors on a yearly basis; however, the water distributors of both furrow systems were almost permanent, and both were members of Fangavo clan of Pare, who were the pioneers of the area around the present Kirisi hamlet. As noted above, Fangavo elders were regarded as the authorities in terms of the allocation of patches of land; they also were recognized as the controllers of water sources. Indeed, most *ndiva*s and furrows used for dry-season irrigation farming near Kirisi hamlet were built by members of the Fangavo clan. Therefore, the water distributors were the descendants of the founders of the indigenous irrigation facilities. The water-users groups selected these persons as the water distributors out of respect for the founders, and the water distributors were proud of their roles and performed them without receiving payment.

These water distributors did not act as gatekeepers. At times, the water distributors appointed a water-use committee with two or three members, and the water distributors worked with the assistance of each water-use committee to perform the following roles:

(a) organizing the water-rotation groups (*Kikundi*, pl. *Vikundi*) discussed below,
(b) establishing a weekly schedule for water allocation to each water-rotation group,
(c) arranging to supply water on request on the designated day of the week,
(d) cleaning *ndiva*s and furrows with plot users,
(e) settling conflicts among plot users, and
(f) negotiating with the water-users groups in the mountains (see below) regarding the schedule for water allocation.

Once organizing the water-rotation groups, water distributors did not have any routine responsibilities and did not act as gatekeepers for the water. As already mentioned, closing and opening the water gates of *ndiva*s were the responsibilities of members of the water-rotation groups, not the water distributors.

III. Water-rotation Groups (*Kikundi*, pl. *Vikundi*)

Under the supervision of the water distributor, the irrigation plot users with seasonal water rights were divided into several water-rotation groups. Neither the field holders of irrigable fields nor the irrigable fields themselves held permanent water rights. A water-rotation group was a group of plot users who obtained water from the same furrow on the same day of the week. Five or six water-rotation

groups acquired water from Monday to Friday or Saturday; Sunday (and sometimes Saturday) was (were) reserved for addressing the water shortage problems of any of the water-rotation groups. Because of the fluctuating locations of plots used for dry-season irrigation farming and the changing identities of plot users, new water-rotation groups were organized every year. At the years when the members per a water-rotation group were plenty, each water-rotation groups was divided into two sub-groups. The plots operated under the aegis of one sub-group had priority for utilizing water during one week, and then the plots operated under the aegis of another sub-group had priority during the next week. Structured according to the limited availability of water, this arrangement enabled one plot to obtain water once every two weeks. Indeed, plot users said that only kidney beans (*maharage*) could survive such a watering schedule. This rotational arrangement continued until the middle of August, when users groups in the mountains prepared to use water.

IV. Negotiations with Water-users Groups in the Mountains (*Mpango*, pl. *Mipango*)

The allocation of water among water-rotation groups constituted one area of water resource negotiations. Another arrangement (*Mpango*) had to do with the access to water of users in Kirisi (the plains) and those in the mountains.

The water users of *ndiva*s on and along the Mbogho and Msogho valleys in the mountains represented potential competitors with the plot users elsewhere for irrigation farming near Kirisi hamlet. Therefore, it was important to establish arrangements between these groups with respect to water use. Water for irrigation was available from May to September for the farming activities in Kirisi. In years characterized by insufficient rainfall, the water use began in May or June so that irrigation facilities could be used to water the crops in the fields during the long rains. In other years, water was used for crops during the long rains beginning in early July, and for dry-season irrigation farming beginning in the middle of July or early August.

During the middle of August, the silt was removed from four smaller *ndiva*s above *Ndiva ya Mbogho* to prepare the fields of villages in the mountains as irrigation facilities. Then, the water reserves of these *ndiva*s were used to irrigate the fields in Mkuu Village in the mountains during one week, and the *ndiva*s were left open or their water reserves were used to add to those of *Ndiva ya Mbogho* for irrigation in Kirisi during the next week. Mkuu and Kirisi used water in alternation 2-week cycles until the end of September. During this period, the plots of two sub-groups in one water-rotation group in Kirisi shared water because mature beans need less water than younger beans. Four small *ndiva*s above *Ndiva ya Sumbwe* were used to irrigate the fields in Vuchama Village, and Kirisi and Vuchama Village operated according to the same arrangements as those governing the Mbogho furrow system.

Water-users groups in the upper stream usually had stronger water rights than did those living downstream. However, the water users groups in the mountains and Kirisi peacefully shared water during the “normal” years of dry-season irrigation farming in Kirisi in the 1990s. One reason for this peaceful arrangement

was that the period for dry-season irrigation farming was too cold for growing crops in the mountains. Another reason concerns the complicated social networks between the villagers in the mountains and the residents of Kirisi, who are connected by kinship/affine relationships. Moreover, residents of Kirisi cared for the fields in the Kirisi blocks owned by villagers in the mountains. This kindness on the part of mountain residents seemed to end in the 2000s due to the increased demand for water for agricultural and domestic purposes in the mountains. This turn of events constituted one of the causes of the decline in dry-season irrigation farming near Kirisi.

CONCLUSION

Beans production near Kirisi hamlet during the dry season seemed to serve as one of the strategies used to cope with the economic hardship caused by chronic drought, the negative effects of structural adjustment programs, and so on. This farming practice, which seemed to represent a collective economic activity organized above the level of individual households, utilized scarce common resources including water during the dry season. Therefore, we would be inclined to assume that this practice was followed by a closed community of the residents of Kirisi hamlet or Vudoi sub-village. However, this article demonstrates that the actual situation was quite different.

First, the use of irrigable fields was available to those outside the pioneering Fangavo clan. Second, flexible and *ad hoc* relationships between field holders and plot users living outside of Kirisi hamlet were the norm. Third, plot users in Kirisi in the plains and those in the mountains were able to establish reasonable water-use arrangements.

Based on the situation as originally observed, we could not imagine an area-based tightly structured organization for dry-season irrigation farming. However, a combination of flexible social networks that went beyond the level of a small community did indeed develop historically.

It is also important to note that rural societies are not static entities. We must observe them carefully from a perspective that situates local initiatives or the ability to cope with socio-economic changes within the wider context. Outsiders who visit Kirisi now cannot recognize the remnants of dry-season irrigation farming previously performed near Kirisi hamlet. However, the present situation is not the result of unchanged in Kirisi; rather, it is the result of two decisions: starting dry-season irrigation farming during the early 1990s and terminating it during the late 2000s. As Mvungi (2008) has noted, the assumption by some development partners instituting a bottom-up approach that "the peasants are regarded as subjects of change whose knowledge and culture is viewed as outmoded" is incorrect.

As supporters of a prototype of community-based organization (CBO) created to promote equitable economic activities from the bottom up, we must re-examine the nature and principles underlying the existing organizations and social networks without drawing on stereotyped images of Tanzanian or African rural communities. Indeed,

we do not have sufficient information on "community". Before starting any projects "for" rural people, we must investigate their indigenous thoughts and practices. Such an approach is fundamental to participatory and sustainable development.

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NOTES

(1) Kiruru Lwami Village was incorporated into Mwanga Ward (Kata ya Mwanga) in the early 1990s; Mwanga Ward was then reorganized into Mwanga Small Township (Mamlaka ya Mji Mdogo Mwanga) in 2006.
(2) The irrigation plots in the Mramba block near the Mramba hamlet of Vudoi Sub-village were used only in 1998 and 1999.

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